

PROBLEM SOLVING

Avoiding Common Errors

Exercises 39–46 A common error in exercises like these is not having the calculator set in radian mode. Since students have probably not used radian mode before, show them how to make this selection from the mode settings. Tell them that they will sometimes be working in degree mode and sometimes in radian mode in this chapter, so they should get in the habit of checking the mode setting whenever they start working with their calculators.



Graphing Calculator

Exercises 42, 43, 46 Since there are no keys for the cosecant, secant, and cotangent functions, students should not be expected to know how to evaluate these functions without some help. Ask them how they think this might be done. It is likely that some students will suggest using the second function keys for \sin^{-1} , \cos^{-1} , and \tan^{-1} , based on the reciprocal relationships

$$\csc \theta = \frac{1}{\sin \theta}, \sec \theta = \frac{1}{\cos \theta}, \text{ and}$$

$$\cot \theta = \frac{1}{\tan \theta}, \text{ which they learned}$$

in Lesson 13.1. Tell students that this is a good guess, but then have them test it with one of the special angles to discover that it is incorrect. Then tell them those keys are used to find inverse functions, which they will learn about in Lesson 13.4. Show them, for example, that $\sec \frac{\pi}{9}$ can

be keystroked as $\frac{1}{\cos \frac{\pi}{9}}$ or by first

evaluating $\cos \frac{\pi}{9}$ and then using the x^{-1} key.



Internet Reference

Exercise 51 For additional information about the use of a centrifuge, visit NASA's website at science.nasa.gov/headlines/y2003/07feb_stronggravity.htm



Animated Algebra

classzone.com

An **Animated Algebra** activity is available on-line for **Exercise 53**. This activity is also available on the **Power Presentations CD-ROM**.

EXAMPLES **A**
1 and 3
on pp. 859–861
for Exs. 48–50

50. See margin for art; -240° , $-\frac{4\pi}{3}$. Sample

answer: The minute hand travels 12 times farther than the hour hand in the 8 hours of work.

EXAMPLE 4 **B**
on p. 862
for Exs. 51–53

53b. 360° . Sample answer: Since each step has a central angle of $\frac{\pi}{8}$ and there are 16 steps, the staircase will cover $16(\frac{\pi}{8})$ or 2π , which is equivalent to 360° .

- 48. ASTRONOMY** In astronomy, the *terminator* is the day-night line on a planet that divides the planet into daytime and nighttime regions. The terminator moves across the planet's surface as the planet rotates. It takes about 4 hours for Earth's terminator to move across the continental United States. Through what angle has Earth rotated during this time? Give the answer in both degrees and radians. **60° , $\frac{\pi}{3}$**

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- 49. CD PLAYER** When a CD player reads information from the outer edge of a CD, the CD spins about 200 revolutions per minute. At that speed, through what angle does a point on the CD spin in one minute? Give the answer in both degrees and radians. **$72,000^\circ$, 400π**

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- 50. ★ SHORT RESPONSE** You work every Saturday from 9:00 A.M. to 5:00 P.M. Draw a diagram that shows the rotation completed by the hour hand of a clock during this time. Find the measure of the angle generated by the hour hand in both degrees and radians. *Compare* this angle with the angle generated by the minute hand from 9:00 A.M. to 5:00 P.M.

- 51. MULTI-STEP PROBLEM** A scientist performed an experiment to study the effects of gravitational force on humans. In order for humans to experience twice Earth's gravity, they were placed in a centrifuge 58 feet long and spun at a rate of about 15 revolutions per minute.

- Through how many radians did the people rotate each second? **$\frac{\pi}{2}$**
- Find the length of the arc through which the people rotated each second. **about 45.6 ft**



- 52. MULTI-STEP PROBLEM** In the shot put event at the 2004 Summer Olympic Games, the winning shot was 21.16 meters. For a shot put to be fair, it must land within a sector having a central angle of 34.92° .

- If the officials drew an arc across the fair landing area marking the farthest throw, how long would the arc be? **about 12.9 m**
- All fair shot puts in the 2004 Olympics landed within a sector bounded by the arc from part (a). What is the area of this sector? **about 136 m^2**

- 53. ★ EXTENDED RESPONSE** A spiral staircase has 15 steps. Each step is a sector with a radius of 42 inches and a central angle of $\frac{\pi}{8}$.

- What is the length of the arc formed by the outer edge of a step? **about 16.5 in.**
- Through what angle would you rotate by climbing the stairs? Include a sixteenth turn for stepping up on the landing. *Explain* your reasoning.
- How many square inches of carpeting would you need to cover the 15 steps? **about 5195.4 in.^2**

Animated Algebra at classzone.com

○ = WORKED-OUT SOLUTIONS
on p. WS1

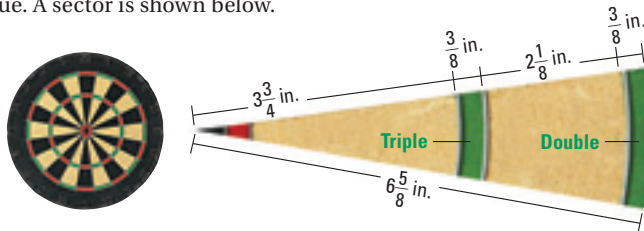
★ = STANDARDIZED
TEST PRACTICE

864

50.



- C** 54. **CHALLENGE** A dartboard is divided into 20 sectors. Each sector is worth a point value from 1 to 20 and has shaded regions that double or triple this value. A sector is shown below.



- Find the areas of the entire sector, the double region, and the triple region. **about 6.9 in.², 0.76 in.², 0.46 in.²**
- A dart you throw randomly lands somewhere inside the sector. What is the probability that it lands in the double region? in the triple region? **about 0.11; about 0.07**

MIXED REVIEW

PREVIEW

Prepare for
Lesson 13.3
in Exs. 55–62.

Simplify the expression. (p. 266)

55. $\sqrt{54}$ **$3\sqrt{6}$**

56. $\sqrt{320}$ **$8\sqrt{5}$**

57. $\sqrt{36} \cdot \sqrt{18}$ **$18\sqrt{2}$**

58. $\sqrt{3} \cdot \sqrt{60}$ **$6\sqrt{5}$**

59. $\sqrt{\frac{5}{49}}$ **$\frac{\sqrt{5}}{7}$**

60. $\sqrt{\frac{27}{64}}$ **$\frac{3\sqrt{3}}{8}$**

61. $\frac{\sqrt{12}}{\sqrt{7}}$ **$\frac{2\sqrt{21}}{7}$**

62. $\frac{\sqrt{28}}{\sqrt{8}}$ **$\frac{\sqrt{14}}{2}$**

Write an equation of the line tangent to the given circle at the given point. (p. 626)

63. $x^2 + y^2 = 53$; (7, 2)
 $7x + 2y = 53$

64. $x^2 + y^2 = 40$; (2, 6)
 $x + 3y = 20$

65. $x^2 + y^2 = 146$; (5, 11)
 $5x + 11y = 146$

Find the number of permutations or combinations.

66. ${}_8P_3$ (p. 682) **336**

67. ${}_7P_4$ (p. 682) **840**

68. ${}_{12}P_2$ (p. 682) **132**

69. ${}_{10}P_8$ (p. 682) **1,814,400**

70. ${}_9C_5$ (p. 690) **126**

71. ${}_{15}C_7$ (p. 690) **6435**

72. ${}_6C_5$ (p. 690) **6**

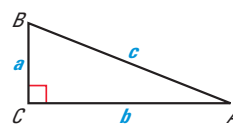
73. ${}_8C_4$ (p. 690) **70**

QUIZ for Lessons 13.1–13.2

Solve $\triangle ABC$ using the diagram and the given measurements. (p. 852)

- $A = 50^\circ$, $a = 14$
 $B = 40^\circ$, $b \approx 11.7$, $c \approx 18.3$
- $B = 70^\circ$, $a = 5$
 $A = 20^\circ$, $b \approx 13.7$, $c \approx 14.6$
- $A = 15^\circ$, $a = 9$
 $B = 75^\circ$, $b \approx 33.6$, $c \approx 34.8$

- $A = 25^\circ$, $b = 10$
 $B = 65^\circ$, $a \approx 4.66$, $c \approx 11.0$
- $B = 42^\circ$, $c = 18$
 $A = 48^\circ$, $a \approx 13.4$, $b \approx 12.0$
- $B = 37^\circ$, $c = 12$
 $A = 53^\circ$, $a \approx 9.58$, $b \approx 7.22$



Find one positive angle and one negative angle that are coterminal with the given angle. (p. 859) 7–10. Sample answers are given.

7. 115° **475° , -245°**

8. 290° **650° , -70°**

9. $\frac{4\pi}{9}$ **$\frac{22\pi}{9}$, $-\frac{14\pi}{9}$**

10. $\frac{7\pi}{5}$ **$\frac{17\pi}{5}$, $-\frac{3\pi}{5}$**

11. Find the arc length and area of a sector with a radius of 8 inches and a central angle of $\theta = 115^\circ$. (p. 859) **about 16.1 in., about 64.2 in.²**

12. **ESCALATOR** The escalator at the Wilshire/Vermont Metro Rail Station in Los Angeles has an angle of elevation of 30° . The length of the escalator is 152 feet. What is the height of the escalator? (p. 852) **76 ft**

EXTRA PRACTICE for Lesson 13.2, p. 1022



ONLINE QUIZ at classzone.com

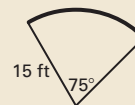
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5 ASSESS AND RETEACH

Daily Homework Quiz

Transparency Available

- Find one positive angle and one negative angle that are coterminal with 475° . **115° ; -245°**
- Convert 315° to radians and $\frac{17\pi}{6}$ radians to degrees.
 $\frac{7\pi}{4}$ radians; 510°
- You are planting a vegetable garden on a plot of land that is a sector of a circle. You want fencing along only the curved edge of the garden. Use the figure to find the length of fencing you will need and the area that will be available for planting. **about 19.6 ft; about 147 ft²**



Online Quiz

Available at classzone.com

Diagnosis/Remediation

- Practice A, B, C in Chapter 13 Resource Book, pp. 16–18
- Study Guide in Chapter 13 Resource Book, pp. 19–20
- Practice Workbook, pp. 183–184
- @HomeTutor

Challenge

Additional challenge is available in the Chapter 13 Resource Book, p. 23.

Quiz

An easily-readable reduced copy of the quiz (with answers) on Lessons 13.1–13.2 from the Assessment Book can be found on p. 850E.